

- 25. Depth** A swimming pool is 12 meters long, 6 meters wide, 1 meter deep at the shallow end, and 3 meters deep at the deep end (see figure). Water is being pumped into the pool at  $\frac{1}{4}$  cubic meter per minute, and there is 1 meter of water at the deep end.
- What percent of the pool is filled?
  - At what rate is the water level rising?

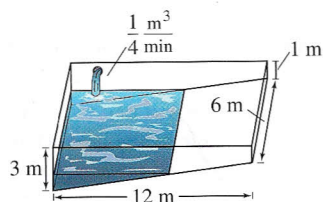


Figure for 25

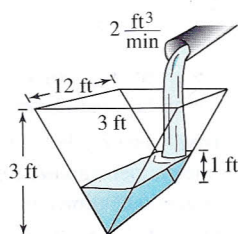


Figure for 26

- 26. Depth** A trough is 12 feet long and 3 feet across the top (see figure). Its ends are isosceles triangles with altitudes of 3 feet.
- If water is being pumped into the trough at 2 cubic feet per minute, how fast is the water level rising when it is 1 foot deep?
  - If the water is rising at a rate of  $\frac{3}{8}$  inch per minute when  $h = 2$ , determine the rate at which water is being pumped into the trough.

- 27. Moving Ladder** A ladder 25 feet long is leaning against the wall of a house (see figure). The base of the ladder is pulled away from the wall at a rate of 2 feet per second.
- How fast is the top moving down the wall when the base of the ladder is 7 feet, 15 feet, and 24 feet from the wall?
  - Consider the triangle formed by the side of the house, the ladder, and the ground. Find the rate at which the area of the triangle is changing when the base of the ladder is 7 feet from the wall.
  - Find the rate at which the angle between the ladder and the wall of the house is changing when the base of the ladder is 7 feet from the wall.

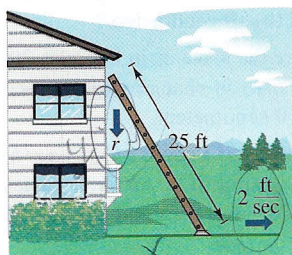


Figure for 27

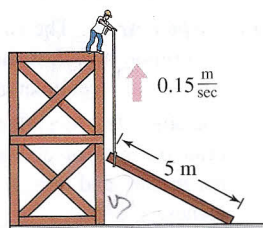


Figure for 28

**FOR FURTHER INFORMATION** For more information on the mathematics of moving ladders, see the article “The Falling Ladder Paradox” by Paul Scholten and Andrew Simoson in *The College Mathematics Journal*. To view this article, go to the website [www.matharticles.com](http://www.matharticles.com).

- 28. Construction** A construction worker pulls a 5-meter plank up the side of a building under construction by means of a rope tied to one end of the plank (see figure). Assume the opposite end of the plank follows a path perpendicular to the wall of the

building and the worker pulls the rope at a rate of 0.15 meter per second. How fast is the end of the plank sliding along the ground when it is 2.5 meters from the wall of the building?

- 29. Construction** A winch at the top of a 12-meter building pulls a pipe of the same length to a vertical position, as shown in the figure. The winch pulls in rope at a rate of  $-0.2$  meter per second. Find the rate of vertical change and the rate of horizontal change at the end of the pipe when  $y = 6$ .

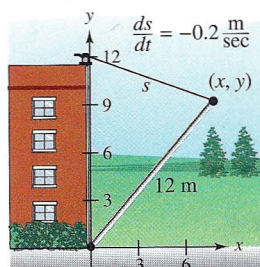


Figure for 29

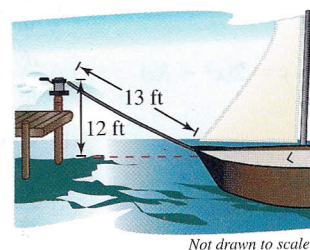


Figure for 30

- 30. Boating** A boat is pulled into a dock by means of a winch 12 feet above the deck of the boat (see figure).

- The winch pulls in rope at a rate of 4 feet per second. Determine the speed of the boat when there is 13 feet of rope out. What happens to the speed of the boat as it gets closer to the dock?
  - Suppose the boat is moving at a constant rate of 4 feet per second. Determine the speed at which the winch pulls in rope when there is a total of 13 feet of rope out. What happens to the speed at which the winch pulls in rope as the boat gets closer to the dock?
- 31. Air Traffic Control** An air traffic controller spots two planes at the same altitude converging on a point as they fly at right angles to each other (see figure). One plane is 150 miles from the point moving at 450 miles per hour. The other plane is 200 miles from the point moving at 600 miles per hour.
- At what rate is the distance between the planes decreasing?
  - How much time does the air traffic controller have to get one of the planes on a different flight path?

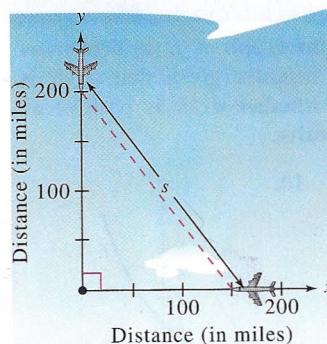


Figure for 31

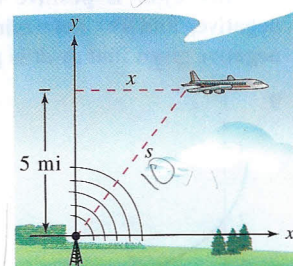


Figure for 32

- 32. Air Traffic Control** An airplane is flying at an altitude of 5 miles and passes directly over a radar antenna (see figure). When the plane is 10 miles away ( $s = 10$ ), the radar detects that the distance  $s$  is changing at a rate of 240 miles per hour. What is the speed of the plane?